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The role of fungi for carbon decomposition in soils of different structure and fresh organic matter content

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Sequestration of C in soils has a major influence on climate change. Fungi play an important role in carbon decomposition and sequestration but the effect of soil structure and input of fresh organic matter (particulate organic matter POM) is still unclear. Fungi is predominant involved in cellulose decomposition and the priming effect (PE) where old SOM is decomposed by using fresh carbon as a source of energy. Information on how soil structure affects colonisation and decomposition of POM and SOM by fungi could help to get explain processes involved in carbon sequestration and CO_2respiration.

The objective of this study was to get a better understanding on the involvement of fungi in CO_2 emissions arising from soils and to gain information on what factors in the soil are driving organic matter (OM) decomposition. Experimental data on fungal growth and carbon decomposition as affected by POM abundance and soil structure were obtained.

Sterilised maize straw (1-2 mm^2) and soil ($<$2mm) were mixed to four different ratios (0, 1.25, 2.5 and 5 % POM per g soil) and packed to two different bulk densities (1.3 and 1.5 Mg m^3). Each sample was inoculated with *Rhizoctonia solani* and stored at 20˚C. CO_2 concentration and the isotopic ratio of carbon were measured regularly over a period of three month to distinguish the C-CO_2 originating from the fresh organic material (POM δ C13 = 12‰) and the C-CO_2 originating from the soil organic matter (SOM δ C13 = 27‰).

Total C-CO_2 derived from the soil increased significantly with increasing POM concentration after the first week. Faster decomposition rates were found in the less compacted soils than in very dense soil. Greater amounts of CCO_2 released from SOM were measured when larger amounts of POM were added with greater differences in soil samples packed to 1.3 Mg g^3 than in soil samples packed to 1.5 Mg g^3.The amount of C-CO_2 produced per mg of C-POM decreased with larger amounts of POM concentrations.

Fungi introduce a PE and therefore large amounts of fresh organic matter incorporated into soils can cause faster decomposition rates of SOM leading to greater releases of CO_2 from the soil. Soil management will also affect carbon decomposition rates as the results showed slower decomposition rates in more dense soils as the fungal spread is probably hindered due to fewer pores the mycelium can grow through.